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The Fourth Report in a Series on

Efficiency in Fruit Marketing

PACKING COSTS FOR CALIFORNIA APPLES AND PEARS

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CALIFORNIA AGRICULTURAL EXPERIMENT STATION
GIANNINI FOUNDATION OF AGRICULTURAL ECONOMICS

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FOREWORD

This report is the fourth of a series aimed at improved efficiency and lowered costs in the local marketing and packing of deciduous fruits. The present report deals only with one segment of packing house operations--the labor and equipment costs associated with the actual packing of fresh fruit. Studies of sample plants during the 1949-50 season indicate that packing rates averaged 12.4 standard boxes per packer-hour in apple plants and 11.5 standard boxes per packer-hour in pear houses. The studies reveal a wide range in efficiency among plants, from day to day within plants, and among individual packers. Standards for reasonably efficient operations have been derived from these studies which, if generally achieved, would free 12 to 15 per cent of the packing labor for other work. In addition to these direct effects, the efficiency of the packing operation may affect the cost of operations throughout most of the plant. Further economies are possible through the choice of a type of packing equipment appropriate to the length of operating season.

These studies were made cooperatively by the Giannini Foundation of Agricultural Economics, California Agricultural Experiment Station, and the Bureau of Agricultural Economics, U. S. Department of Agriculture. They were made under the authority of the Research and Marketing Act of 1946.

Efficiency in Fruit Marketing

PACKING COSTS FOR CALIFORNIA APPLES AND PEARS

B. C. French[1]

THE JOB OF PACKING

The operations in plants packing fruit for shipments to distant markets may be classified into several broad groups. These include within-plant transportation of the raw materials and finished products; grading of the field-run fruit; materials supply; loading for shipment; miscellaneous jobs such as lidding, stamping, tallying; and "packing" or placing the fruit in boxes. This report is concerned only with the labor and equipment costs for the last of these groups--packing fruit intended for fresh consumption.

Types of Packing Equipment

One of the widely used types of packing equipment is the canvas bin (Figure 1-A). The fruit drops into the bins from rope sizers and rolls down the sloping canvas bottoms to the packer. Bin boys are commonly used to keep the fruit piled up at the bottom of the bins where it is most convenient for the packers. In addition, they may push boxes on conveyors, occasionally set off packed boxes for packers, and give other minor assistance.

Two different types of tub systems are commonly observed. All of the apple plants studied used the small 2½-foot tubs set in double rows (Figure 1-B). The pear plants used both large tubs with 7½-foot diameters (Figure 1-C)--with packers on both sides--and small 3-foot tubs similar to those used for apples. Both types of tubs have spring-weighted bottoms that keep the fruit at a convenient level, and both rotate in order to keep the packers evenly supplied with fruit. Curtain or rope sizers are commonly used in pear plants while weight sizers were observed in all apple plants.

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[1] B. C. French is a cooperative agent of the California Agricultural Experiment Station and the Bureau of Agricultural Economics, U. S. Department of Agriculture.

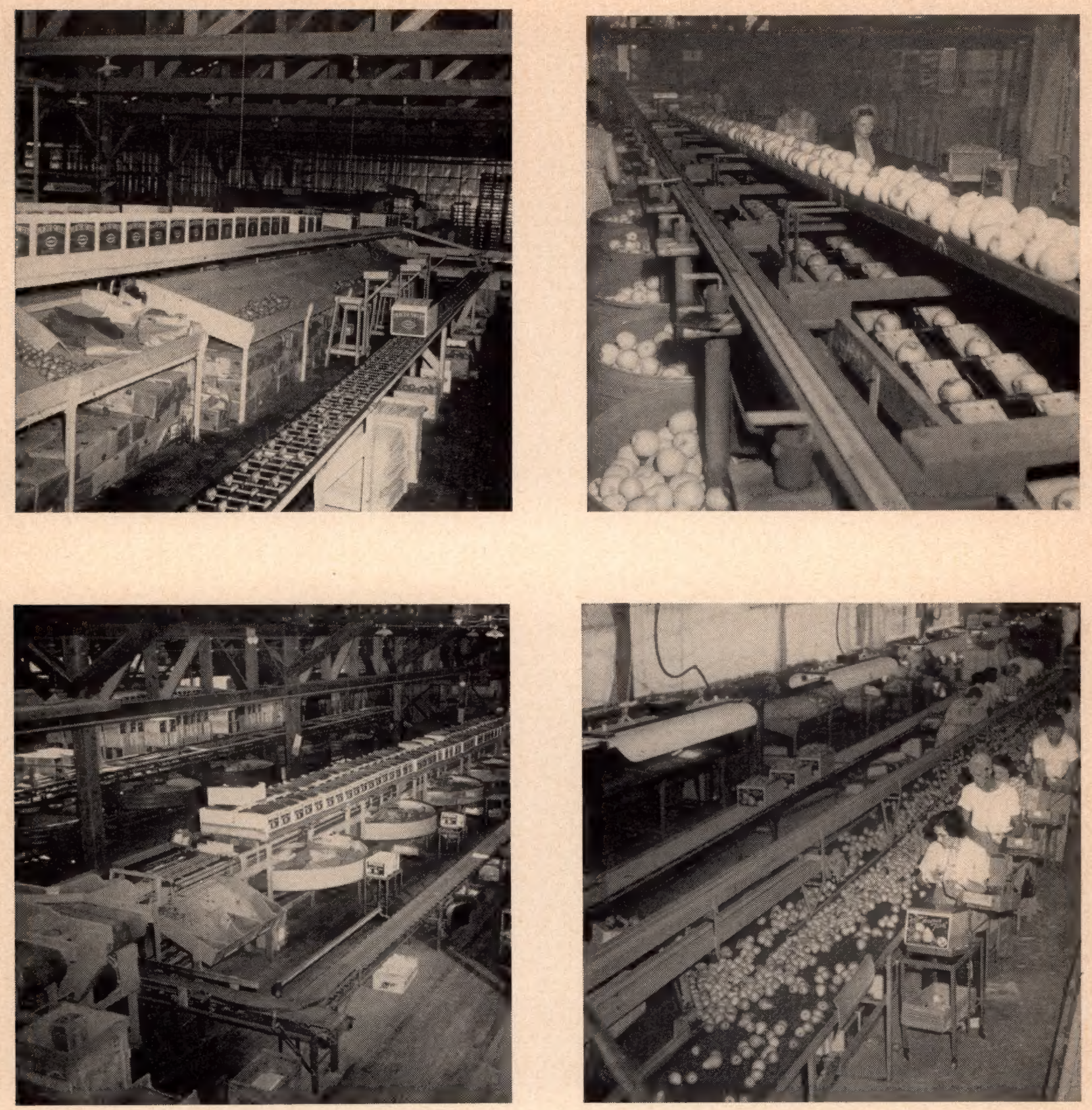

Fig. 1. Four types of packing equipment for pears and apples: Upper left, packing bins; upper right, small tubs with weight sizer, used for apples; lower left, large tubs commonly used in pear packing; lower right, conveyor belt for pear packing.

Another type of packing equipment--a continuous belt line--was observed in several pear packing houses (Figure 1-D). In this system the fruit is packed directly from conveyor belts on which the fruit circulates past the packers who select the particular size to be packed.

Shipping Containers

Most pears shipped out of the state are wrapped and packed in standard pear boxes containing 48 pounds of fruit. The bulk of the pears for local markets, and some for out of state, are packed naked or unwrapped in San Francisco lugs holding about 48 pounds of pears or in Los Angeles lugs usually containing 24 to 25 pounds of fruit.

Most apples destined for distant markets are wrap-packed in standard apple boxes, the net weight varying with the variety. Gravensteins, the major California variety, average about 42 pounds per box. Fruit for local markets is often placed loosely in used Northwest apple boxes.

The Packing Operation

The job of packing consists of placing the fruit firmly and uniformly in the box so as to avoid damage in transport and to present an attractive package to the buyer. The main elements of the work operation include obtaining and placing the fruit box, stamping the box with the packer's number, placing and adjusting pads and liners, wrapping and place-packing the fruit, and moving the packed box from the packing stand to the conveyor that transports it to the lidder. A small amount of time is cocasionally needed to obtain a new supply of wraps from a central storage place.

Minor variations in these work elements occur among plants. For example, in pear packing houses the fairly stiff, easily adjusted liner is commonly placed in the empty box before it is supplied to the packer; in apple plants a more flexible liner that is customarily used may require some adjustment in the box and is often inserted by the packer rather than by another worker.

Influence on Plant Costs

Packing labor represents the most important single component of the packing house wage bill. It accounts for roughly half of the total labor cost in California pear and apple packing plants. Packers are key workers whose output has a substantial effect on the efficient utilization of labor and equipment in the entire packing house. Many of the jobs in the plant, such as tallying, stamping, lidding, setoff, and others, require that the worker remain in a given place and perform certain operations on the fruit as it comes to him. Studies show that workers of this type may be idle a considerable portion of the time and could often handle more fruit with little increase in man-hour inputs. Thus, greater packer productivity may result in lower over-all average costs.

In addition, effective use of the packers--sometimes overlooked because usually they are paid on a piece-rate basis--will give them higher take-home pay. This will result in improved labor relationships and reduced pressure for higher piecework rates.

PERFORMANCE STANDARDS AND EFFICIENCY FACTORS

Packing time requirements, derived from detailed studies of packing operations, are given in Table 1. These are average requirements for "average" packers when fully supplied with fruit. While some individuals require more time per box and others less, the typical worker should usually approximate the indicated times.

The time requirements given in Table 1 are net times and do not include allowances for normal delays and rest periods. These amount to 4.2 per cent for rest periods, .8 per cent for changing stations, and 4 per cent for personal time. When added to the net time this gives the total time required per box. This gross time may be regarded as a "standard time" for reasonably efficient operation and is used in the calculation of the performance standards given in Table 2.

These performance standards are calculated in terms of boxes per hour and for fruit of several sizes. When expressed relative to the average of the various sizes packed in each type of container, the standards are:

TABLE 1

Packing Time Requirements for California Gravenstein Apples and Bartlett Pears[a]

Bartlett pears	Size--number of fruit per standard box							
	90	100	110	120	135	150	165	180
Minutes per standard box								
Nonpacking time[b]	.344	.344	.344	.344	.344	.344	.344	.344
Packing time	2.273	2.575	2.877	3.179	3.632	4.085	4.538	4.991
Total time	2.617	2.919	3.221	3.523	3.976	4.429	4.882	5.335
Minutes per San Francisco lug								
Nonpacking time[b]	.304	.304	.304	.304	.304			
Packing time	1.481	1.706	1.931	2.156	2.494			
Total time	1.785	2.010	2.235	2.460	2.798			
Minutes per Los Angeles lug								
Nonpacking time[b]	.204	.204	.204	.204	.204			
Packing time	.687	.771	.855	.939	1.057			
Total time	.891	.975	1.059	1.143	1.261			

Gravenstein apples	Size--number of fruit per standard box							
	88	100	113	125	138	150	163	180
Minutes per standard box								
Nonpacking elements[b]	.687	.687	.687	.687	.687	.687	.687	.687
Packing elements	2.192	2.406	2.637	2.851	3.082	3.296	3.527	3.830
Total time	2.879	3.093	3.324	3.538	3.769	3.983	4.214	4.517

[a] Fruit in standard boxes is wrapped; Los Angeles and San Francisco lugs, usually containing only the larger sizes, are naked pack.

[b] Breakdown of nonpacking elements:

	Pears			Apples
	Standard box	San Francisco lug	Los Angeles lug	Standard box
	minutes per box			
Get box	.103	.103	.077	.103
Stamp packer number	.063	.063	.063	.063
Set off box	.138	.138	.064	.138
Get new supply of wraps	.040	--	--	.040
Get and adjust liners	.---	--	--	.343
	.344	.304	.204	.687

TABLE 2

Performance Standards for Packing California Pears and Apples[a]

Bartlett pears	Size--number of fruit per standard box							
	90	100	110	120	135	150	165	180
Standard boxes per packer-hour	20.9	18.7	17.0	15.5	13.8	12.4	11.2	10.3
San Francisco lugs per packer-hour	30.7	27.2	24.5	22.2	19.6			
Los Angeles lugs per packer-hour	61.4	56.2	51.7	47.9	43.4			

Gravenstein apples	Size--number of fruit per standard box							
	88	100	113	125	138	150	163	180
Standard boxes per packer-hour	19.0	17.7	16.5	15.5	14.5	13.7	13.0	12.1

[a] The standards include allowances of 4.2 per cent for rest periods, .8 per cent for changing stations, and 4 per cent for personal time.

Bartlett pears--13 standard boxes, 21.4 San Francisco lugs or 46.6 Los Angeles lugs per packer-hour; Gravenstein apples--15.5 standard boxes per hour.

The relation of the standards to actual daily performance is illustrated in Figures 2 and 3, considering all of the sample plants together. Each dot on the diagrams represents, for one plant, the number of packers and their actual combined average hourly rate of output--in terms of standard boxes--on a particular day of season.[1] The standard combined rate for any number of packers is represented by the straight lines through zero. In other words, the lines show the total output per hour of a given number of packers, working at the rates indicated by the performance standards--13 standard boxes of pears and 15.5 standard boxes of apples per packer-hour.

Hourly rates of output in nearly all of the sample plants equaled or exceeded the standards on some days during the seasons studied. Of the total days observed, 23 per cent in the apple plants and about 20 per cent in the pear plants were on or above the standard. In other words, these standards are well within the range of actual performance.

Season average rates of output per packer-hour for the plants represented in Figures 2 and 3 are illustrated in Figure 4.[2] These averages reflect days of inefficient as well as efficient operation and thus tend to fall somewhat below the performance standards. On this basis, only two of the pear plants and none of the apple plants exceeded the standards, as indicated in Figure 4, although apple plants A and B did exceed the standards in 1947, a year of large volume and possibly larger fruit size. The following are among the major factors which account for the inefficient days and for the variations in average rates of production among plants.[3]

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[1] The data are primarily for 1949, with the 1947, 1948, or 1950 seasons also represented for some plants.

[2] This report is based on studies in 8 apple packing houses and 14 pear packing houses. Detailed information on average rates of output for packers, however, was available only for 7 of the apple and 8 of the pear houses. Data for plant T are for 1950; all others are 1949.

[3] Several factors affecting packing rates are not considered. These include temperature variations and time at the beginning of the season during which the packers are getting back into practice. These effects are relatively minor, however, as the summer weather in the areas considered tends to be fairly uniform. Also, many of the packers pack other kinds of fruit--traveling from region to region during the year--so that the period of adjustment in most plants is usually very short.

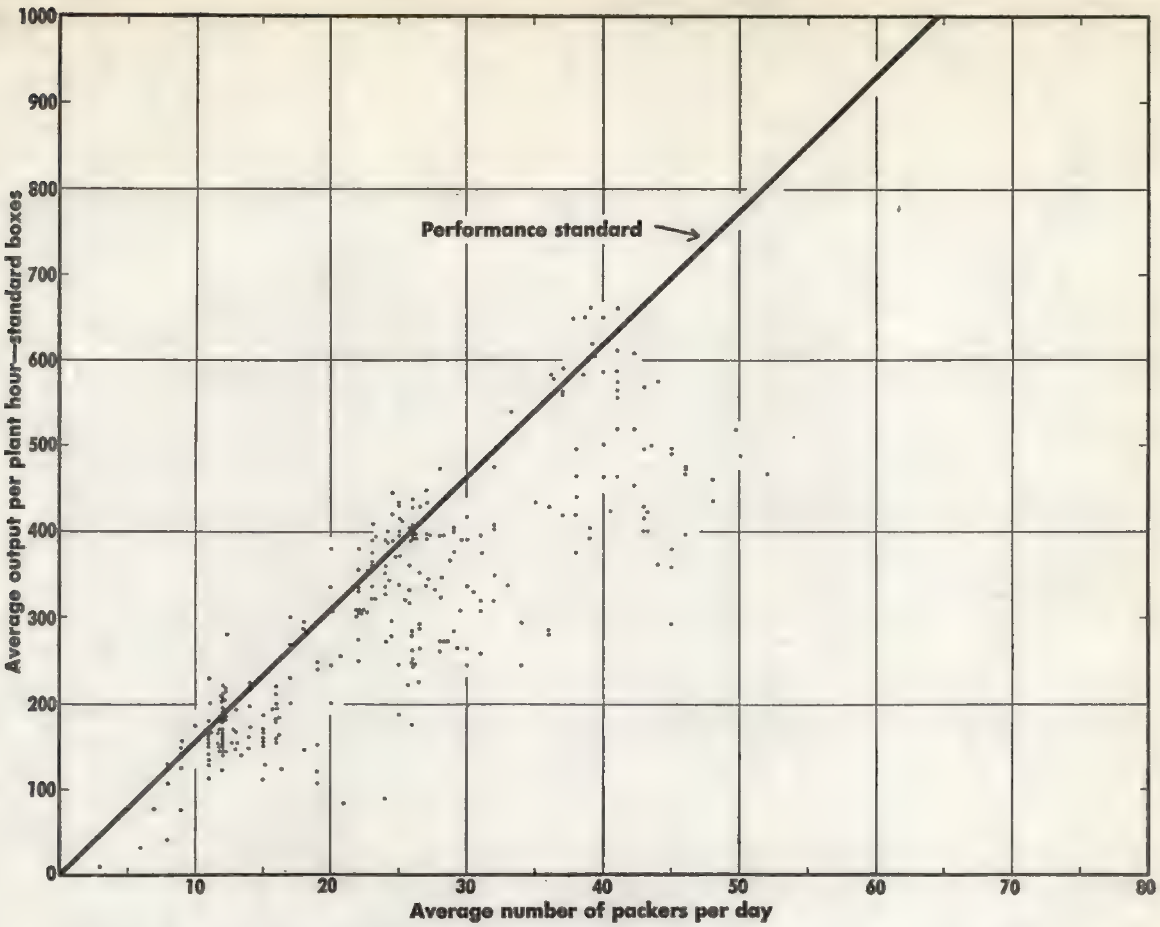

Fig. 2. Average number of packers per day and hourly rates of plant output for seven California Gravenstein apple packing houses.

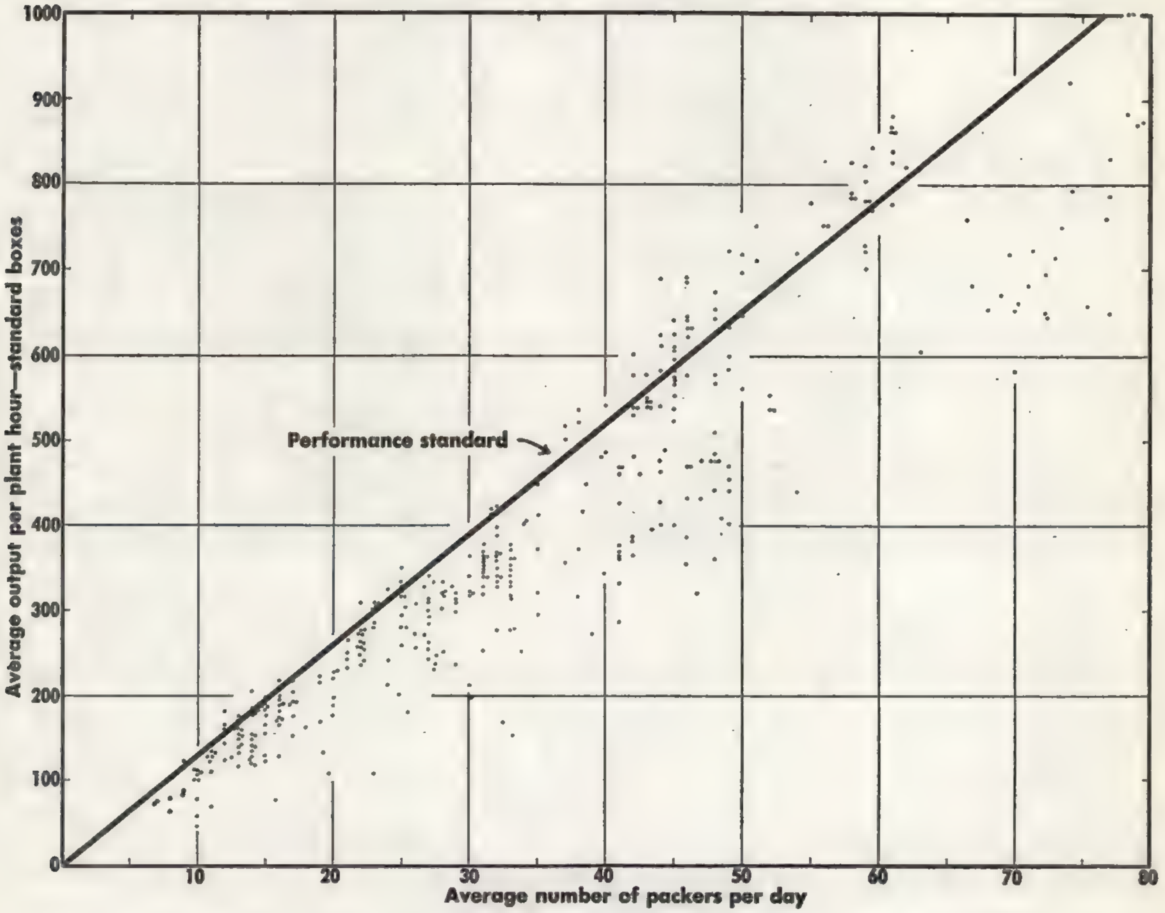

Fig. 3. Average number of packers per day and hourly rates of plant output for nine California Bartlett pear packing houses.

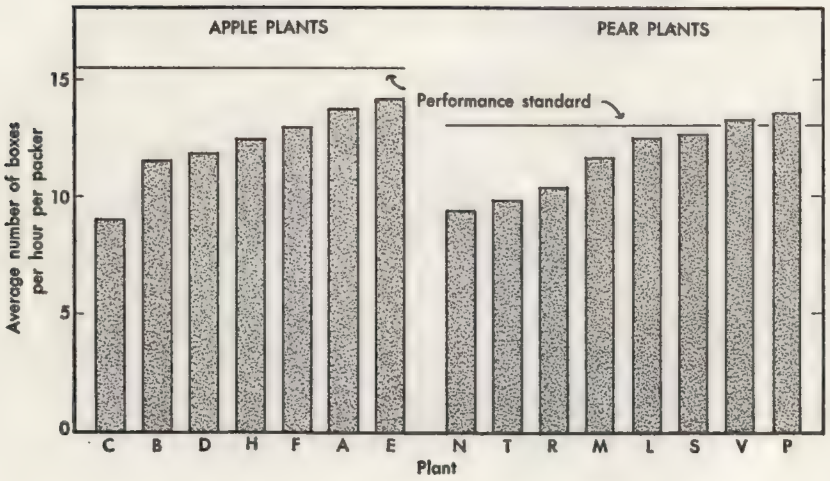

Fig. 4. Average number of standard boxes packed per packer hour for 15 California pear and apple packing houses—1949 season.

1. Size of fruit

Reported fruit size distributions, illustrated in Figure 5, indicate that relatively few boxes are packed in the extreme size groups, the bulk of the fruit averaging between size 135 and 150 for pears and about 125 for apples.1/ Some variation in the average of all sizes may be expected from year to year and from day to day within a season, but, in general, the variations are not large. However, even within fairly narrow limits, changes in size may significantly affect rates of output. For example, the performance standards of Table 2 show that an increase in the average of all sizes packed in standard boxes, from 150 to 135, will raise output on the average by 1.4 boxes per packer-hour--an increase of 12 per cent.

2. Skill of individual packers

As indicated in Figure 4, the season average rate of output per packer-hour varies considerably from plant to plant and, as shown in Figures 2 and 3, from day to day within plants. In addition, for any particular day there will usually be a wide variation in the rates of output among individual packers. An example of this variation is given in Figure 6. These diagrams show for typical 8-hour days the percentage of packers packing various number of boxes per hour above and below the average for all packers. For example, 3 per cent of the pear packers achieved a rate of output 5 to 6 boxes per hour less than the average for all packers; 17.7 per cent were 1 to 2 boxes below average; 9.5 per cent were 2 to 3 boxes above average; and so on.

Due to the large number of factors influencing the rates of production in the plants studied, the determination of the relative levels of packer skill among the different plants was not feasible. However, the fairly wide variations in skill among individual packers--pictured in Figure 6--indicate that by careful selection of workers, managers may effectively increase rates of plant output.

1/ Records of the California Tree Fruit Agreement and cooperating packing houses. The average for pears is 143, although there is, of course, no box packed that actually contains 143 fruit.

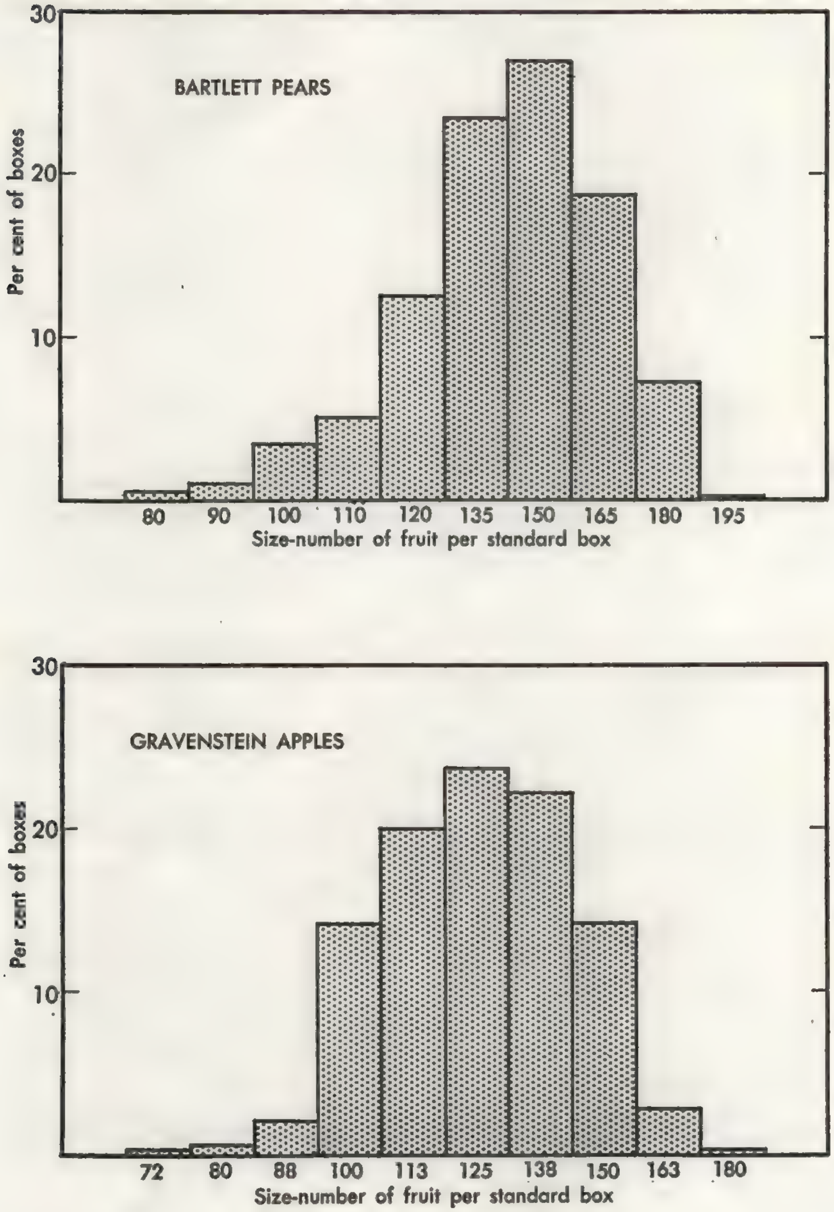

Fig. 5. Reported fruit size distributions for California Bartlett pears and Gravenstein apples packed in standard boxes.

[illegible]

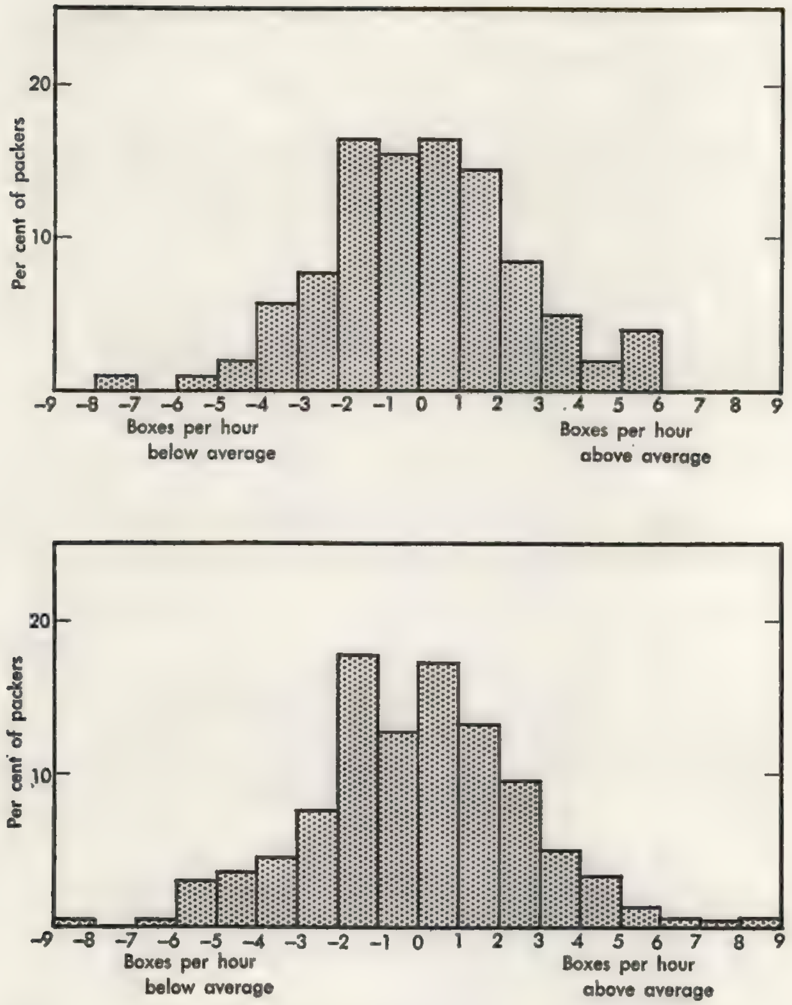

Fig. 6. Average variation in rate of output of standard boxes among individual packers in five California apple packing houses and nine pear packing houses.

3. Irregular flow of fruit

Irregularity in the flow of fruit to the packers may have a considerable influence on the realized rates of production. One of the more important irregularities is the delay in plant operations due to "break-for-lots," i.e., the interruptions that occur when changing from one grower's fruit to that of another.[1/] This type of delay, considered in more detail in a following report of this series, affects most of the operations in the plant. In the sample plants using break-for-lots procedures, the estimated average time lost at the sorting tables ranged from 11 minutes to 1 minute per lot. The total time lost, which depends also on the number of lots run per hour per line, varied from 28 per cent in plant N to 3 per cent in plant S. Packers work during the major part of the "break" period, but their average rate of activity and of output is greatly reduced. Thus, the full impact of the break cannot be measured directly. However, studies show that on the average an absolute increase of 10 per cent in the time lost at the sorting table results in a decrease in the average output per packer-hour of .72 standard boxes of pears and .86 standard boxes of apples--approximately a 5-per cent loss in output.

During the periods of study in each of the cooperating pear plants, the average realized rate of output was 11.8 standard boxes for 8 plants using "break-for-lots" procedures and 12.9 boxes for 2 plants not using this system. The average time lost at the sorting tables was 9.4 per cent. If there had been no break periods, it is estimated that the average rate of production in these 8 plants would have been 12.5 boxes per packer-hour, which compares more favorably with the plants operating without break-for-lots.

In some of the apple plants, "loose" or "jumble" packed fruit for local markets is often placed in boxes by the sorting crews, diverting most of the fruit from the packing lines and leaving the packers nearly idle for extended periods. Plant H, for example, during the period of the 1950 study, utilized an average of 8 per cent of the operating time in this manner, with particular days as high as 16 per cent.

[1/] This procedure is avoided in some plants by using sampling procedures in accounting to growers for quality and quantity of fruit. Single-producer concerns do not, of course, have such problems.

Since the packers are paid by the box, the idleness of these workers does not add to the average costs. However, unless the associated hourly workers are fully utilized in handling loose fruit, or are otherwise occupied, payment for their unused time must be added to the plant costs. Moreover, excessive interruptions may affect the plant's ability to attract good packers.

Another factor affecting the flow of fruit to the packers is the "peaking" of particular size groups. Output may be reduced through failure or inability to adjust sizing equipment to spread out the peak sizes and so permit a larger proportion of the packers to work on the sizes where the volume of flow is largest and most constant.

Other delays or factors which influence the rate of flow of fruit to the packers include: diversion of more than normal amounts of first-grade fruit in pear plants to "cannery"; variation in the proportion of subgrade fruit from lot to lot; equipment failures; and failure of fruit to arrive from the field. Since these are usually relatively minor, they are not considered in this report other than to point out that they may have an important effect on cost and efficiency.

4. Adjustment of crew size

Actual plant production is shown in Figures 2 and 3 to fall below the suggested performance standards on many days. Several factors--packer skill, fruit size, and irregular flow of fruit--have been discussed as factors influencing efficiency, explaining why some of the dots on the diagrams fall below the standards. Even after making due allowance for these elements, however, many of the dots would still fall below the standard. More packers were employed than were actually required for the volume of fruit handled--achievement of the packing-performance standard would have required a reduction in the size of the packing crew.

This failure to adjust the packing crew to the actual rates at which fruit is being handled is partly a result of a method of payment whereby the packer is paid only for actual output and not his time. However, even more important as a deterrent to change is the uncertainty concerning future fruit quality and volume and future labor supplies which confronts the plant management.[1]

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[1] The inflexibility of crew size, together with the more frequent occurrence of delays at the beginning and end of the season when volume is low, often results in a seasonal pattern of packer productivity. Average output per packer-hour tends to rise as the season gets under way and falls off a little toward the end.

5. Type of packing equipment

Since all of the sample apple houses used the small tubs, the effect of type of equipment on apple packing rates could not be determined in this study. However, detailed studies of individual pear packers and of entire packing crews failed to reveal consistent differences in packing efficiency for the three types of equipment described earlier.

The results of these studies are summarized in Table 3 in terms of average boxes packed per productive packer-hour. The top half of the table refers to studies of individual packers taken over short periods of time and when supplies of fruit were adequate. These figures indicate that there were not very marked differences in the average rate of packing any given type of box from the three types of equipment. Moreover, the differences that are indicated are not consistent--packing from tubs, for example, gave the lowest rate of output in standard boxes and the highest rate in Los Angeles lugs.

The lower half of the same table shows the results of studies based on all packers in a number of plants and represents the average rates of output for periods of several days. These rates have been adjusted to eliminate the effects of delay and idle periods and show the average outputs for periods while actually working. Probably, the rates are more indicative of normal packing house operations than the individual packer studies, however, and in general show somewhat lower rates of sustained output. These data suggest that, over a period of time, the output per packer-hour is highest with packing belt equipment and lowest with packing bins.[1] However, both the highest and lowest rates of output shown in Table 3 were achieved by bin plants.

The absence of consistent differences in the data in Table 3 is not surprising in view of the basic similarity among the three types of equipment in the elements of the packing operation itself. The physical packing job can differ only in the distance reached for the fruit. Measurements indicate that with "heaped-up" fruit the average distance reached in bins may be about

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[1] The study was made in only one belt house--this kind of equipment being used in very few Bartlett pear plants. As a consequence, the rate of achievement may be less generally indicative of potential performance than are the several figures for each of the other types of equipment. The degree to which these figures may have been influenced by differences in the average skill of packers among plants is not known.

TABLE 3

The Effect of Type of Packing Equipment and Type of Container on Output Per Productive Packer-Hour, Bartlett Pears

		Average rate of output--boxes per packer-hour		
		Standard box	Los Angeles lug	San Francisco lug
Individual packer studies				
Bins		15.8	50.8	26.0
Tubs		13.5	52.6	--
Belt		14.3	50.4	22.4
Packing crew studies				
Bin plants	L	12.9	46.2	--
	M	14.1	--	23.2
	N	12.1	43.4	19.9
	R	12.2	43.7	20.1
	S	15.3	--	--
	T	12.0	--	19.8
Average		13.1	44.4	20.8
Tub plants	P	13.7	49.1	--
	U	13.7	49.1	22.6
	W	13.9	49.8	22.9
Average		13.8	49.3	22.8
Belt plants	V	14.1	50.5	--

2 inches less than in tubs and 4 inches less than with belts--this out of a total reach of 20-28 inches. Reference to tables of standard work data indicates that the effect on time requirements of such differences in distance would be quite small.

With belt packing, another consideration is the decision that must be made by the packer as to the correct size when reaching for the fruit. This undoubtedly has, to an unknown extent, a restrictive effect on the rates of output. However, the problem of size peaks discussed previously is largely eliminated with belt packing. Thus, although the basic time requirements per box may be slightly higher for this equipment, the realized rate of output compares very favorably with that of other methods.

While the sizing may be slightly less uniform with belt packing, no quality deterioration was noted due to this method nor was there market discrimination in the form of lower prices.

On the whole, then, considering the results of these studies and the nature of the job itself, it seems reasonable to conclude that there is no important difference in packing rate associated with a particular type of equipment.

COST COMPARISONS

Hourly Earnings and Cost Per Pound for Packing Labor

Potential hourly earnings of packers and costs of packing labor per pound of fruit vary somewhat according to type of package. The data summarized in Table 4 suggest that, with the 1950 wage schedule, the Los Angeles lug permitted the highest hourly earnings--$2.80 per hour as compared to $2.02 for the standard pear box, $2.14 for San Francisco lugs, and $1.86 for apples. While deviations from the indicated average sizes would alter the earnings figures, the differences are large enough that one may conclude that piecework rates for Los Angeles lugs were not comparable with those for standard boxes and San Francisco lugs.

The higher level of packer earnings in pear plants, as compared to apples, is in conformity with a situation which also has been commonly observed

TABLE 4

Potential Hourly Earnings and Cost Per Pound for Packing Labor--California Bartlett Pears and Gravenstein Apples

	Pears			Apples
	Standard box	Los Angeles lug	San Francisco lug	Standard box
Average of all sizes[a]	143	124	124	125
Performance standards--boxes per hour	13.0	46.6	21.4	15.5
Pay rate per box--1950 wages (cents)	15.5	6.0	10.0	12.0
Potential average hourly earnings (dollars)	2.02	2.80	2.14	1.86
Packing labor cost per 100 pounds (cents)	32.3	24.5	20.8	28.6

a/ Size is measured in terms of the number of fruit in a standard box. There is, of course, no specific size of either 143 or 124. These figures represent averages of all sizes packed.

for hourly rate workers. Wage rates in pear houses are generally above those in apple plants.

The piecework rates for the several types of containers tend to be quite uniform among plants--much more so than the hourly rates for other workers. However, inasmuch as the average size of fruit may vary from plant to plant, particularly in different geographic areas, the hourly earnings of packers of the same skill may be less uniform than those of workers actually paid by the hour. Thus, for comparable wage rates throughout the industry, the average size of fruit packed should be an important factor in establishing piece rates in any plant or geographic area.

From the packing house point of view, with uniform piece rates, the direct packing labor cost per pound for a given type of box remains the same regardless of average fruit size. However, the packing cost per pound does vary with the type of container as shown in Table 4. The higher costs for standard boxes are a result of the added operation of wrapping the fruit, but the higher cost for standard pear boxes as compared to standard apple boxes is a result of the relatively higher piece rates for pear packing. Similarly, the higher per-pound cost for Los Angeles lugs, as compared to San Francisco lugs, is a result of the relatively higher pay rates for these boxes. Thus, an adjustment of the relative levels of the piece rates would also tend to equalize the per-pound costs of packing in these containers.

Packing Equipment Costs

The relative costs of the packing operation with the different types of equipment depend on several of the factors discussed previously--the skill of the packers, the average size of fruit, and the regularity of fruit supply. Many of these factors vary from plant to plant, so any simple comparison is questionable. The general nature of relative costs may be suggested by estimates based on standard boxes, average fruit size and capacity rates of operation based on the performance standards in Table 2.[1]

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[1] Only one type of apple packing equipment, small tubs, was observed in the plants studied. Therefore, no comparisons could be made. For pears, however, costs associated with three types of equipment were studied--bins, belts, and 7½-foot tubs. The small tubs, less commonly used for pears and slightly higher in cost, will not be considered separately.

Such estimates are summarized in Table 5. Investments in equipment are estimated on the basis of 1950 prices and costs and have been converted to estimates of annual costs by applying standardized rates for depreciation, repairs, insurance, taxes, and interest. Direct packing labor is entered at the going piecework rates per standard box. The wages of two bin boys are included for each bin packing line as this was the most commonly observed arrangement. Other costs, such as the costs for electrical power and for plant floor space, undoubtedly differ somewhat among the three types of equipment, but their effects would be minor and have been ignored.1/

The estimates stress the fact that the advantage of bin packing equipment lies in its relatively low original investment and annual equipment costs. In addition, shorter sections of packed-box conveyor, together with the availability of bin boys to occasionally push the boxes, permit the use of relatively low-cost gravity conveyors rather than the powered belts usually found in belt and tub plants.

The disadvantage of bin plants, on the other hand, is that extra labor costs are involved for the bin boys.

As indicated by the estimated direct packing costs per box, the bin plants have a significant cost advantage over the other types--when hours of operation per season and total volume per season are low. With the equivalent of 50 hours of capacity operation, this advantage amounts to 3.6 cents per box less than tub equipment and 2.4 cents per box less than packing belt equipment. At 150 hours of operation per season, bin and belt equipment packing costs are about equal and each have an advantage of 0.4-0.5 cents over tub plants. If hours of operation amount to 200 per season, tub and bin costs are about equal. For all hours of operation above 200, belt plants show the lowest costs, bin plants the highest costs, and tub costs are intermediate.

Where operating conditions or the grades and sizes packed do not permit the full utilization of the normal capacity per packing section (line 3, Table 5), additional packing equipment will be needed for a given output, and costs

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1/ Although floor space is not important in the above comparison, in planning reorganizations with existing plants such differences might well be quite significant. For these purposes approximate floor requirements per section for equipment, packing stands, and packed box conveyors can be represented by: bins--20 x 42 feet; tubs--17 x 80 feet; and belts--12 x 60 feet.

TABLE 5

Estimated Costs of Operating Bin, Tub, and Belt Packing Lines, Bartlett Pears

	Bins	Tubs[a]	Belts
Approximate length per packing section (feet)	42	80	60
Packers per section	13-15	18-20	15-17
Normal capacity--standard boxes per hour	182	247	208
Installed cost, 1950[b] (dollars)	1,300	6,520	4,100
Annual equipment cost[c] (dollars)	213	880	615
Packing labor cost per box, 1950 (cents)	15.5	15.5	15.5
Bin boy labor costs per hour[d] (dollars)	2.10	—	—
Estimated Cost Per Box With[e]			
50 hours' operation per season (cents)	19.0	22.6	21.4
100 hours' operation per season (cents)	17.8	19.1	18.5
150 hours' operation per season (cents)	17.4	17.9	17.5
200 hours' operation per season (cents)	17.2	17.3	17.0
250 hours' operation per season (cents)	17.1	16.9	16.7
400 hours' operation per season (cents)	16.9	16.4	16.2

[a] Based on large tubs—7 per section. Costs for small tubs slightly higher, depending on spacing of tubs.

[b] Includes cost of packed box conveyors with powered belts for tub and belt plants and gravity conveyor for bin plants.

[c] Total allowances for annual costs of depreciation, repairs, insurance, taxes, and interest: bins--16.4 per cent of original investment; tubs--13.5 per cent; belts--15 per cent.

[d] Two bin boys per section at $1.05 per hour each.

[e] Includes only the cost items indicated in the upper part of the table.

will be somewhat higher than indicated in Table 5.[1] With 200 hours of operation per season, for example, a reduction in the hourly output per bin packing section from 182 to 150 boxes per hour--a decrease of about 20 per cent--would increase costs from 17.2 cents to 17.6 cents per box. For shorter seasons, the effects of underutilization are slightly more pronounced; with a 100-hour season, this same decrease in volume rate would raise costs from 17.8 cents to 18.3 cents per box.

A similar reduction of about 20 per cent in tub output to 200 boxes per hour would increase costs from 17.3 cents to 17.7 cents per box for a 200-hour season and from 19.1 cents to 19.9 cents for 100 hours. In belt plants a 20-per cent decrease in utilization--from 208 to about 170 boxes per hour--would increase costs from 17.0 cents to 17.4 cents for 200 hours of operation and from 18.5 cents to 19.1 cents for 100 hours. Any plant able to exceed the normal capacity would, of course, realize slightly lower costs.

The costs for bin plants may be reduced somewhat, as compared to those of Table 5, by utilizing part of the bin-boy labor for other operations. These workers must be continually available to the packers but, in the sample bin plants, were actually working only 60 per cent of the time. One plant utilized part of this time by having the bin boys keep the records on packer production through a system of punch cards. Studies of clerical-labor requirements indicate that, with 30 per cent idle time, the bin boys can absorb the additional function with little trouble. The desirability and feasibility of this arrangement will vary according to the specific plant setup.

With a typical three-section bin plant, the labor of one tally girl might be replaced by the six bin boys. Thus, only 5/6 of their labor is devoted to bin-boy functions; the other 1/6 to tallying. The bin-boy costs (line 7, Table 5) then amount to $1.75 rather than $2.10 per hour. Under these circumstances, bins are less costly than belts for all hours of operation per season up to 200 and have an advantage over tubs up to 250 hours. Beyond 250 hours, bins show the highest cost, with belts lowest, and tubs intermediate.

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[1] Within limits, longer working hours may be substituted for additional packing equipment, but any resulting advantages are likely to be lost through higher pay rates for overtime.

POTENTIAL SAVINGS

The data in Table 5 indicate that packing houses with very short or very long seasons may find that one type of packing equipment has a distinct cost advantage over the others. However, the normal length of operating season for most California Bartlett pear plants is such that the possible gains from using a particular type of packing equipment are not large. The packing houses usually operate between 100 and 300 hours per season, with 200 a common figure. For an average season of 200 hours, there is little difference in cost among the three methods. However, these small differences, when added to other small savings throughout the entire plant, may add to a substantial figure.

Considerable variation was noted among plants in the average rates of packer production and in adjustment to the major factors influencing packing efficiency. Some packing houses have achieved a relatively high degree of efficiency--particularly in view of the short seasons and uncertainties associated with both labor and fruit supply--while in others important economies could be realized. Potential savings in packer-hours that would have resulted from general achievement of the suggested standards for reasonably efficient operation by the sample plants are indicated in Table 6. Relatively large savings would have been possible for plants F, N, R, and T, for the indicated season. On the other hand, plants P and V actually exceeded the standards and so have already realized in large measure the gains from higher packer efficiency.

If the standards were achieved by all California pear and apple houses, it is estimated that at least 30,000 packer-hours in pear plants and 16,000 packer-hours for apples could be freed each year for other work. The greater efficiency which would permit the release of these workers would also be reflected in increased efficiency of many other plant operations and so reduce over-all plant costs.

TABLE 6

Potential Savings in Packer-Hours for 15 California Apple and Pear Packing Houses, 1949 Season[a]

Plant	Total boxes packed per season			Total packer-hours used	Packer-hours at standard rate	Possible savings packer-hours
	Standard	San Francisco	Los Angeles			
A	40,671	—	—	2,971	2,624	347
B	30,376	—	—	2,642	1,960	682
C	13,548[b]	—	—	1,504	874	630
D	26,283	—	—	2,222	1,696	526
E	16,970[b]	—	—	1,205	1,095	110
F	69,075	—	—	5,372	4,456	916
H	44,490	—	—	3,594	2,870	724
	241,413	—	—	19,510	15,575	3,935
L	67,897	—	—	5,517	5,223	294
M	33,105	6,195	—	3,185	2,836	349
N	90,558	2,061	11,724	10,235	7,315	2,920
P	100,862	—	7,605	7,699	7,923	0
R	92,301	33,412	—	10,938	8,661	2,277
S	85,425	—	—	6,737	6,571	166
T	60,139	10,220	—	6,694	5,104	1,590
V	121,106	—	147,256	12,317	12,476	0
	651,393	51,888	166,585	63,322	56,109	7,596

[a] Data for plant T are for 1950 season; 1949 unavailable.

[b] Includes major part of season; data for remainder unavailable.

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